Contribution ID: **61** Type: **Oral Presentation**

Grain refinement of high-Mn wear-resistant cast steel by means of heterogeneous nucleation

Tuesday, 24 September 2024 13:50 (20 minutes)

The understanding and controlling of the primary solidification, particularly the formation of first grains, is of significant relevance. Generally, high-Mn steels exhibit a coarse-grained microstructure in the millimeter range and are known for their high strain hardening ability and thus, excellent cyclic deformation resistance. In order to further improve the cyclic mechanical properties, this study aims to increase the strength of the alloy via grain refinement.

From a comprehensive literature research, the nonmetallic inclusions AlCeO3 and Ce2O3 were identified as the most promising particles for the heterogeneous nucleation of austenite. Based on this literature review, various grain refining agents were evaluated, and test melts were carried out. With the grain refining agent from ELKEM (WearSeed), it was possible to reduce the grain size by over 80% (from 1550ym to 285ym). However, the process window for a successful grain refinement is only very small. Extensive thermodynamic calculations with FactSage on the interaction of O-S-Ce-Al in high-Mn steel melts, and particle analyses of the potential nuclei by automated SEM-EDS were carried out.

The framework conditions for a successful grain refinement were systematically developed depending on the casting temperature, dissolved O and S, and the addition of Al and Ce. Finally, the static and cyclic mechanical properties of the grain refined high-Mn steel cast were determined using tensile and low cycle fatigue testing and showed very promising results.

Speaker Country

Austria

Primary author: PRESOLY, Peter (Montanuniversität Leoben)

Presenter: PRESOLY, Peter (Montanuniversität Leoben)

Session Classification: Session 4

Track Classification: Casting and Solidification of Liquid Metals